CLAIMS

1. A gene detection system for detecting a target gene upon hybridization with a probe, said gene detection system comprising:

a probe-immobilizing support on which a probe is immobilized; and

heating and cooling means disposed in contact with another location different from the surface of the probe-immobilizing support on which the probe is immobilized.

2. A gene detection system according to Claim 1, wherein the heating and cooling means comprises a soaking component disposed in contact with the surface opposite the surface of the probe-immobilizing support on which the probe is immobilized, and a heating and cooling element disposed in contact with the soaking component.

3. A gene detection system according to Claim 2, wherein the thermal capacity of the soaking component is greater than the thermal capacity of the probe-immobilizing support.

4. A gene detection system according to Claim 2 or 3, wherein the soaking component comprises a temperature sensor for measuring its temperature , and

controls the actuation of the heating and cooling element based on the temperature measured by the temperature sensor.

5. A gene detection system according to Claim 2, wherein the heating and cooling element consists of a Peltier element or heater.

6. A gene detection system according to Claim 1, constructed in such a way that the thermal flux is propagated through the probe-immobilizing support between the heating and cooling means and a solution containing the target gene in a state where part or all of the probe-immobilizing support is immersed in the solution containing the target gene.

7. A gene detection system according to Claim 1, wherein the probe-immobilizing support comprises an electrode on which the probe is immobilized and an electrode substrate for supporting the electrode.

8. A gene detection system according to Claim 7, wherein the circumferential surface of the electrode is covered with a heat insulating member, and said gene detection system being constructed in such a way that the thermal flux from the heating and cooling means flows through the electrode substrate, past the electrode end face, into the solution containing the target gene.

9. A gene detection system according to Claim 7, wherein the electrode is equipped, at least on the surface thereof, with a portion comprising gold, silver, or copper, and the electrode substrate comprises a ceramic material.

10. A gene detection system according to Claim 7, wherein the electrode comprises a plurality of electrodes.

11. A gene detection system according to Claim 7, wherein the electrode comprises a plurality of electrodes so that a plurality of types of probes may be immobilized on each electrode,

the electrode substrate comprises a plurality of electrode substrates supporting the plurality of electrodes, respectively, and

the heating and cooling means independently controls the temperature of each of the plurality of electrode substrates.

12. A gene detection device, comprising a gene detection system according to Claim 1, and control means for controlling the actuation of the heating and cooling means.

13. A method for detecting genes using a gene detection system according to Claim 7, wherein the heating and cooling means is actuated to adjust the probe-immobilizing support to a desired temperature, and the double strand formed upon the hybridization of the target gene with the probe is electrochemically detected.

14. A method for detecting genes using a gene detection system according to Claim 7, said method for detecting genes comprising:

the step of allowing a target gene to hybridize with the probe to form a double strand; and

the step of measuring the electrode reaction response as the heating and cooling means is actuated to vary the temperature of the probe-immobilizing support, and detecting the double strand on the basis of the relationship between the temperature and the electrode reaction response.

15. A method for detecting genes according to Claim 14, wherein the electrode reaction response is continuously measured as the temperature of the probe-immobilizing support is varied.

16. A method for detecting genes according to Claim 14, wherein DNA that is a full match with the base sequence of the probe and DNA that is a partial mismatch with the base sequence of the probe are allowed to hybridize with the probe, and

the proportion in which the full match DNA and partially mismatched DNA are present is determined by continuously measuring the electrode reaction response as the temperature of the probe-immobilizing support is varied.

17. A method for detecting genes according to Claim 14, wherein the electrode reaction response is measured as the heating and cooling means is actuated to continuously vary the temperature of the probe-immobilizing support.

18. A method for detecting genes according to Claim 14, wherein the electrode reaction response is

measured as the heating and cooling means is actuated to vary the temperature of the probe-immobilizing support in steps.

19. A chip for detecting genes, comprising an electrode on which a probe is immobilized, an electrode substrate for supporting the electrode, and a soaking component disposed in contact with the surface opposite the surface of the electrode substrate supporting the electrode,

the soaking component comprising a temperature sensor for measuring its temperature.